Exploring the *Forma Urbis Romae* Fragments: A New Approach

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Paper presented as part of "Special 150th Panel – Mapping the Classical World Since 1869: Past and Future Directions" at the *Annual Meeting of the Society for Classical Studies*, 3-6 January, 2019 San Diego

[Slide 1] The scope and complexity of the Great Marble Map of Rome make it an unparalleled resource, but also complicate attempts to work with its immense volume of fragmentary data. Originally covering an area of over 2,500 square feet, [2] it depicted the architectural footprint of every ground floor room in the city, from the Colosseum cavea to the interior of sprawling apartment structures. It was recovered in around 1,200 known fragments, some subsequently lost. Making sense of this data would be difficult in the best of circumstances, but the logistics of dealing with the sheer mass of marble involved has drastically limited access to the map. Imagine a puzzle where you have an estimated 10-15% of the picture, broken into 1,200 mostly non-contiguous pieces, each of which weighs dozens of pounds in cut marble.

Various technological revolutions have improved access to the map. Drawings on vellum of select fragments were superseded by expensive but comprehensive printed plate volumes. The internet and three-dimensional scanning opened new possibilities for documentation and access. Now we are launching a new undertaking: the Great Marble Map of Rome Project. This project

will use newly available technology to take the next steps in research on this unique and invaluable artifact.

[3] The Great Marble Map, or *Forma Urbis Romae*, or Severan Marble Plan (more on that in a second) has always presented particular challenges for access, challenges that have shaped scholarship. Up to this point scholars' primary interest in the map has been to piece the plan together, and to identify and connect depicted buildings with structures known from the historical or archaeological records. These approaches tend to engage with the monument at the level of the fragment or individual depiction. To some extent this is a product of access, since it has been difficult to study more than a few fragments at a time. While topographic inquiries are certainly worthy pursuits, scholars have pointed out that such approaches downplay the original display context of the map. [4] The majority of the depiced buildings are generic, unidentifiable structures that would have been difficult even to see, given that the original dimensions of the map were a staggering 18 x 13 meters, or around 60 x 43 feet.

The newest approaches to the Great Marble Map move beyond focus on individual buildings, to look at what can be learned from the plan as a whole. Such approaches require better access to both the fragments and their original context. [5] It is here that the Great Marble Map of Rome Project has taken up the torch. The project is sponsored by the Ancient World Mapping Center at the University of North Carolina, Chapel Hill, in partnership with the Musei Capitolini and Sovrintendenza Capitolina ai Beni Culturali in Rome. [6] The mission of our project is to use new technology to achieve several goals. These are:

1) To give wide and comprehensive virtual access to all aspects of the map
2) To advance scholarship on the map and to take it in new directions
3) To encourage public engagement with the Great Marble Map, particularly with regards to the actual fragments in Rome

Our primary means of achieving these goals will be a new website and online database that makes available three dimensional scans of all 1200 fragments and their original context.

[7] Our inaugural enterprise for the project has been a photogrammetric scan of the wall on which the Great Marble Map was once mounted. The wall that now forms the north exterior face of the Basilica dei Santi Cosma e Damiano was originally an interior wall of a room within the Temple of Peace. Although the majority of the marble was robbed in the Middle Ages, pieces were excavated at the foot of the wall, confirming the wall's association with the monument. [8] The wall was divided into two zones, an upper section on which the map was mounted, and a tall socle below. The 150 or so marble slabs that once made up the map were fastened to the brick wall with metal clamps. [9] The holes for many of these clamps are still preserved in the wall, despite modern interventions such as the insertion of windows. Since many marble fragments also preserve corresponding clamp marks on their back face, it should be possible, in theory, to align the clamp marks on the fragments with the clamp marks on the wall, reconstructing the original position and alignments of fragments. Previous attempts to do so, however, have been uncertain and slow, since they relied on working with the actual fragments and scale drawings of the wall. Three dimensional models of all the fragments, however, were produced around 2002 by the Stanford Digital Forma Urbis Romae Project. What was needed was a corresponding model of the wall.

Our project's solution was to make a three-dimensional scan of the wall itself using Fan Photogrammetry. Generally speaking, this type of photogrammetry works much like a stereoscope. The process produces a series of overlapping but offset images, that, viewed through the proper two-toned glasses, create a three-dimensional effect. Modern camera techniques and capabilities mean that this can be accomplished at an amazing level of detail over large areas and from considerable distances.

[10] Mission Wall Scan was launched in May 2019, when a team traveled to Rome to take the necessary photographs for building the three-dimensional images of the wall. The research division of our team consisted of Dr. Richard Talbert of the Ancient World Mapping Center, Dr. Francesca De Caprariis of the Musei Capitolini, and Dr. Elizabeth Wolfram Thill (that's me!) of IUPUI. [11] We were joined by a technical team from Queens University, Ontario led by Dr. George Bevan, assisted by Kristen Jones and Dr. Daryn Lehoux.

I am indebted for all technical descriptions of this process to Kristin Jones, who kindly provided more specific understanding than my "and then we took pictures of the wall." [12] The Queens University team employed a fan photogrammetry technique, shooting at 7 Gigapan stations with their camera mounted to a fence along the sidewalk of the Via Imperiali, approximately 50 meters away from the face of the wall. [13] Scale was achieved using custom coded scale bars, two in a right angle L configuration, and two more in windows across the wall. This allowed the team to imitate aerial photographic mapping techniques. [14] The Queens team shot 30 images at

each of the 7 stations using a telephoto lens with a 1.5 mm ground pixel size. [15] To deal with the variable weather, Dr. Bevan and his team shot 4 sets of photographs over 3 days. [16] This method allowed them to capture the part of the wall where the map was mounted. [17] In order to capture the socle zone, primarily for conservation purposes, Dr. Bevan photographed the area by hand from a distance of 5 meters, shooting straight on for one set of photos and then upwards at a 45 degree angle to link the images with the larger data set of the whole wall.

[18] Our initial product is a three dimensional record of the wall that once held the Great Marble Map. It is so precise that despite being shot from 50 meters you can zoom in and see the textures of individual bricks. With the correct glasses, the effect is surreally three dimensional. [19] Given the right software, you can measure the space between holes and even the depths of the holes themselves within 1 mm of accuracy. [20] In addition, Kristin Jones was able to use the merged high resolution orthophoto to trace individual features of the wall using 3DM analyst and AutoCAD. [21] Her end production is a series of precisely scaled drawings that highlight the clamp marks on the wall.

[22] The next step will be to make these images of the wall available online as part of our new website. In the final presentation researchers will be able to directly compare the three dimensional models of the fragments with the clamp marks on the wall scan. This should not only facilitate reconstruction and new joins among fragments, but will allow researchers to gain a clearer understanding of the physical setting of the Great Marble Map. What sort of distance, for example, separated various depicted structures? Are the sizes of inscriptions related to position on the wall? How is the work of different carvers distributed throughout the map and

along the wall, and what does this suggest about the logistics of carving? These are just some of the questions we hope our new presentation can encourage and investigate.

[23] The second initiative undertaken as part of our project is to further facilitate research on the Great Marble Map fragments. Because access to the fragments has been limited to a close circle of specialists mostly working with identifiable depictions, basic issues such as nomenclature and referencing systems have never been fully addressed. For example, there is no standardized system for referring to features represented on a given fragment. While this is not a problem when referencing structures such as the Colosseum, it becomes problematic when wanting to refer to, say, individual rooms around an unidentified peristyle. This will become more of an issue as scholars increasingly ask research questions that depend on generic, unidentified structures.

Even the name of the monument itself needed updating. Without going into too much detail here, we rejected anything pseudo-Latin, overly technical, or otherwise unintelligible to a broader public. Instead we decided to stick with the basics: the Great Marble Map of Rome. I therefore used this name for this presentation, in the belief that if you say it enough, you can make fetch happen.

We are still working on a system for numbering the individual fragments and features, but as I will show, modern technology can make the presentation of a system much simpler. New software makes it easy to color code and annotate three dimensional models, making them more

understandable for map experts, researchers new to the map, and the interested public. I am indebted here to my colleagues Jenny Johnson and especially Derek Miller at IUPUI Library's Center for Digital Scholarship. With Derek's help I was able to paint a pilot model using Mudbrick and display the finished project via Sketchfab, none of which process actually changes the underlying data. The original model shown here was produced as part of the Stanford Digital Forma Urbis Romae Project and is under the copyright of the Sovritendenza. All models are supposed to carry the Sovritendenza's watermark, but I am not tech savvy enough to do that yet. Indeed, I should add that I am completely new to this, like since December, so please forgive the rough edges.

What you see here is a section of the marble map currently known as 3ab. This section was drawn in the Renaissance as one large piece in a sketch now preserved in a Vatican Codex. Sometime later a section of it was lost and replaced by a cast. [24] Here is the newly painted model. I have marked inscriptions in red, commercial structures in yellow, columns in green, and arcades in blue. Crucially you can still manipulate the model, spinning it to check possible joins and clamp marks (this one doesn't actually have clamp marks, because I chose my pilot model desperately and poorly). One methodological problem that can arise when working with the Great Marble Map is that it is often not obvious to non-specialists what is actually extant. This view of the model has the cast features dimmed to highlight the distinction between what is marble and original and what is not. This view goes further, removing all markings from the cast to really emphasize what is actually preserved.

Sketchfab also opens up great potential for annotating models. Part of the previous challenges in creating a numbering system was a basic inability to display any such system in a legible form. Sketchfab can make presenting a numbering system less cumbersome. In this mock-up, I have added reference numbers to each feature. Feature 3.1 is an inscription, Feature 3.2 the street, Feature 3.3 the colonnaded courtyard, and Feature 3.8 a commercial room. Crucially, you can toggle the annotations off and on as needed.

Another potential for annotation is to open the audience for the models. In this version, I have annotated the model for the Roman specialist. The cast has the full reference number for the codex drawing, and the inscription has its official epigraphic transcription. In this version, I have modified the annotations for the interested non-specialist, say an amateur historian. The cast annotation explains the history of the fragment, and the inscription annotation explains the transcription. My favorite possibility, however, is that the model can be annotated in order to develop curricula for students of various ages. In this version I have written the annotations for a grade school audience. The cast annotation spells out the history more plainly, and the inscription annotation teaches vocabulary such as the term “inscription.”

We hope these new forms of presentation help discover not only new physical but also conceptual links across fragments. In terms of physical joins, by clarifying what each puzzle piece represents, the color coding should make it simpler to see what we are searching for in a match. In this case for example,we are looking for a commercial peristyle building along this edge, or more simply, a yellow and green building above a red inscription. In a more theoretical

vein, this presentation holds great potential for researching into the representations of architecture. How are *domus* represented? What features of temples are emphasized? What can the depictions of public leisure parks tell us about how such spaces were conceptualized?

The most exciting aspect of the website, however, is that its ultimate goal is to facilitate work with the extant fragments themselves. Previously this would have been a vain hope, since the map fragments were inaccessible in storage. [25] But there is a new, as yet unnamed museum coming to Rome, as part of the Musei Capitolini. The brainchild of Dr. Francesca De Caprariis, this museum will house all the map fragments in the Sovritendenza's care. Indeed, our team was privileged to see all of them in their new home during our work in May. Many fragments will be on display in a permanent exhibit dedicated to the Great Marble Map. The other fragments will be easily accessible for visiting researchers.

[26] The location of the new museum has great potential to engage a wide public audience. [27] Located in a former gymnasium for Mussolini's Fascist Youth, the museum is within sight of the upper tiers of the Colosseum. [28] An attached garden will house an epigraphy museum showcasing numerous architectural membra that were deposited there in the large scale excavations of the late 19th and early 20th centuries. And a service building will eventually house the most important features of Roman culture, a gelateria and caffe.

The website will thus serve as an international gateway for the new museum. Scholars can develop hypotheses online, and then test those hypotheses against the actual fragments in Rome.

Study abroad groups planning to visit Rome can start a curriculum about the Great Marble Map in the classroom, and then continue that curriculum in the new museum and on the streets of Rome. For example, a student could prepare a presentation on the Colosseum fragments in the classroom, deliver it in the museum utilizing the actual fragments, and then continue the presentation at the Colosseum itself.

All of this is early days for our project. But our goals are in progress and achievable. We want to use new technology to make the Great Marble Map more accessible. We want to advance research and take it in new directions. And we want to achieve a wider audience beyond academia.

We have some moonshot dreams we have in mind but are not in specific process yet. We would like to make new scans of all the fragments, to improve the underlying models and speed painting and annotation. Although cutting edge at the time, the Stanford scans reproduce only the basic outline of the fragment. They are also in a fossilized .ply format, meaning they must be individually converted to a more accessible .obj format and UV wrapped, a time consuming and error prone process. New laser scanning can quickly produce a paintable model that captures color and texture, as well as more precise contours.

In terms of public engagement, we want to develop an extended set of curricula that will allow students from 1st to 20th grades to engage with the Marble Map online with the ultimate culmination being a visit to the museum in Rome. We want to develop an app that would allow

tourists to take the Marble Map out with them into the streets of Rome and juxtaposed against the ancient monuments. We want to develop a virtual reality experience that would allow a viewer to walk around the reconstructed walls of buildings represented on the Marble Map. We want to maintain a database that is continually updated to represent advances in the field. We want to have a crowd sourcing feature, where interested assistants can work to find joins between fragments.

[29] Not all of these dreams will be immediately attainable. But we are already bringing undergraduate students into our project through an IUPUI Digital Scholarship Fund. Graduate students are standing by at the Ancient World Mapping Center. We have the drive, we have the ideas, and we have a plan.

Great Marble Map

Exploring the ~~Forma Urbis Romae~~ Fragments: A New Approach

Elizabeth Wolfram Thill

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Above L: Temples in the Forum Holitorium? (AG 31h,i,l; Thill)
Below L: Theater of Marcellus (AG 31q-s; Thill)
Above R: Roman *insula,* including domus, fountain, shops, and stairway (AG 101l-m; Stanford)

Nomenclature

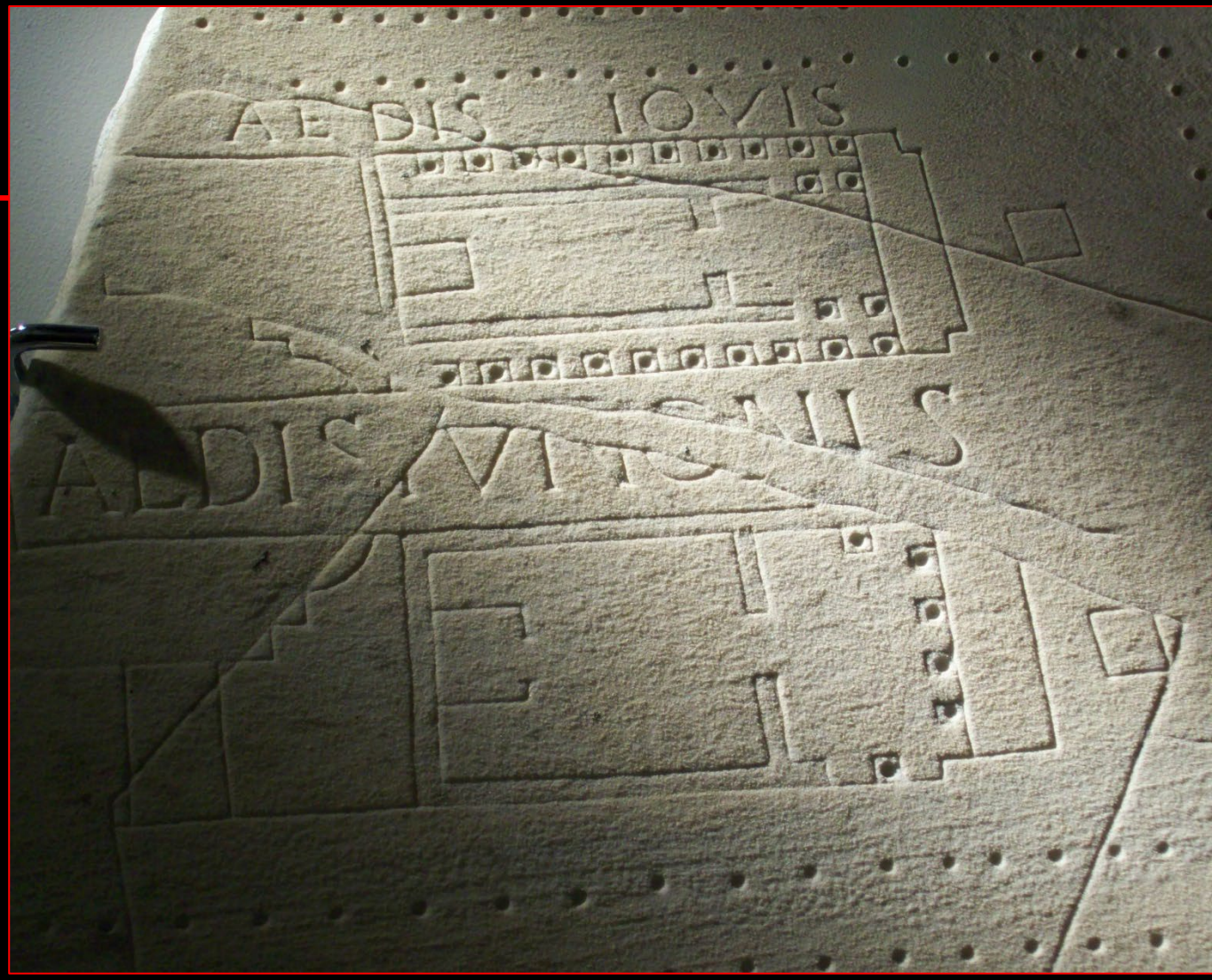
Great Marble Map of Rome

=

Forma Urbis Romae

=

Severan Marble Plan



Temples to Iupiter and Iuno in Porticus Octaviae
(AG 31aa, bb, u, v; Thill)

Roman *insula,* including domus, fountain, shops, and stairway (AG 101l-m; Stanford)

Imperial Forums Archive; watercolor rendition by Ink Link

Great Marble Map of Rome Project

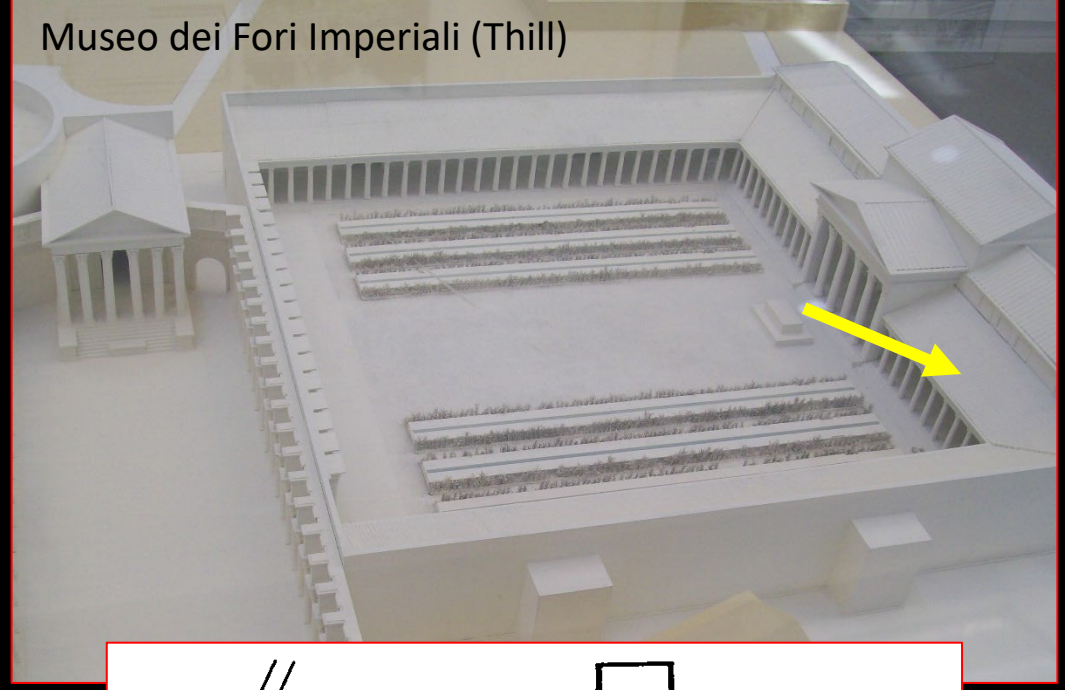
- Ancient World Mapping Center (UNC-Chapel Hill)
- Musei Capitolini and Sovrintendenza Capitolina ai Beni Culturali

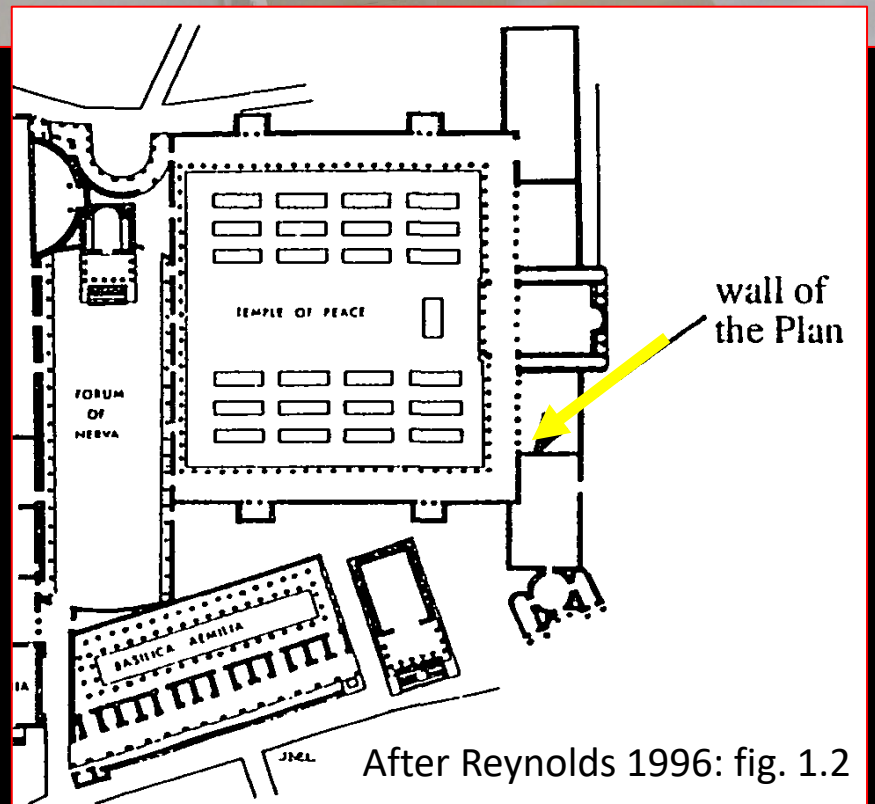
Goals

- Give virtual access to all aspects of the map
- Advance scholarship and take in new directions
- Encourage public engagement, particularly with actual fragments

Templum Pacis

Note *Forma* wall

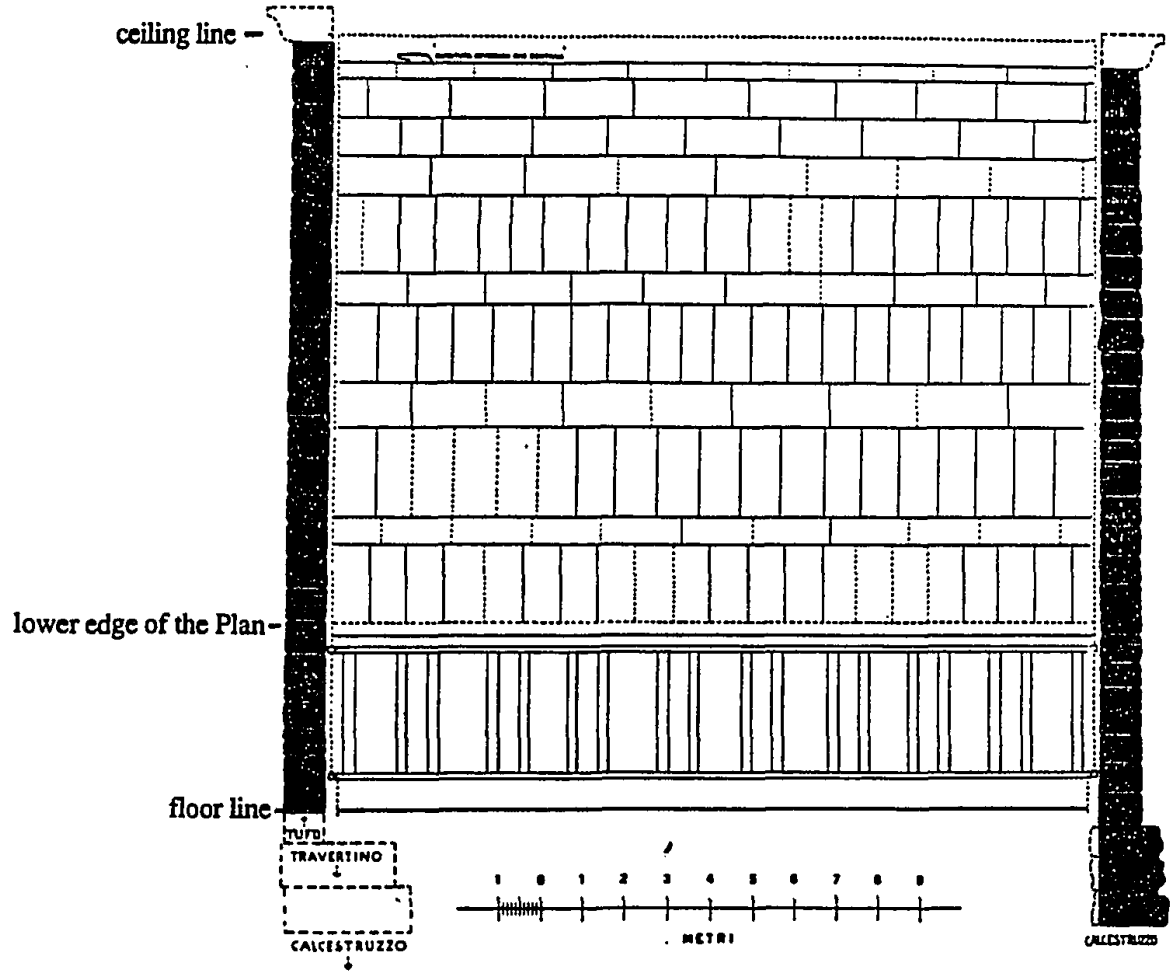

Museo dei Fori Imperiali (Thill)



After Reynolds 1996: fig. 1.2

map

socle



Reconstruction of layout of slabs on wall (Reynolds 1996: fig. 1.32)

north exterior face of the Basilica dei Santi Cosma e Damiano (Thill)

map

socle

ceiling line

lower edg


Dr. Richard Talbert
Dr. Francesca De Caprariis
Dr. Elizabeth Thill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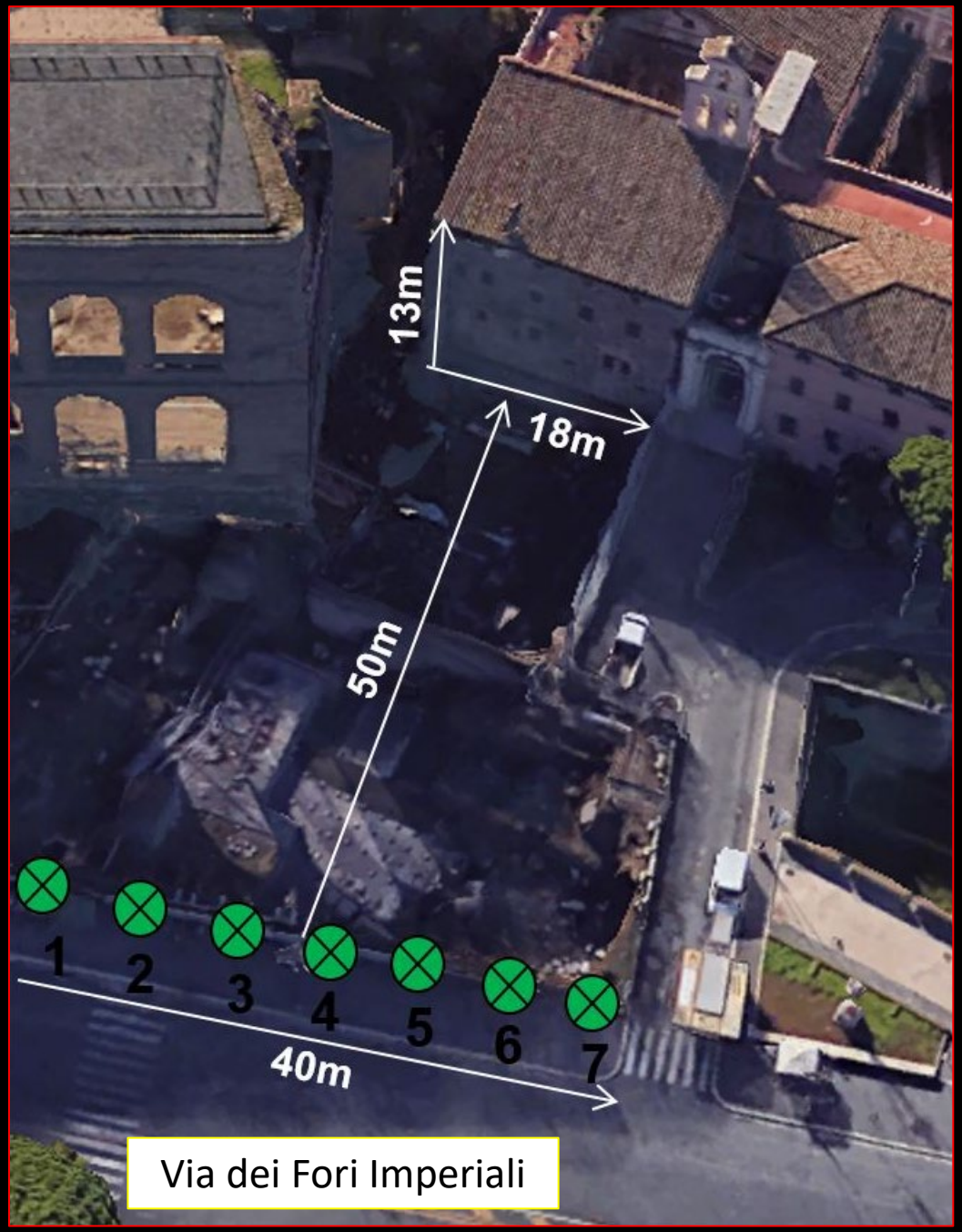
Dr. Francesca De Caprariis
Dr. George Bevan
Dr. Daryn Lehoux
Kristen Jones
Dr. Elizabeth Thill


13m
18m
50m
1
2
3
4
5
6
7
40m
Via dei Fori Imperiali

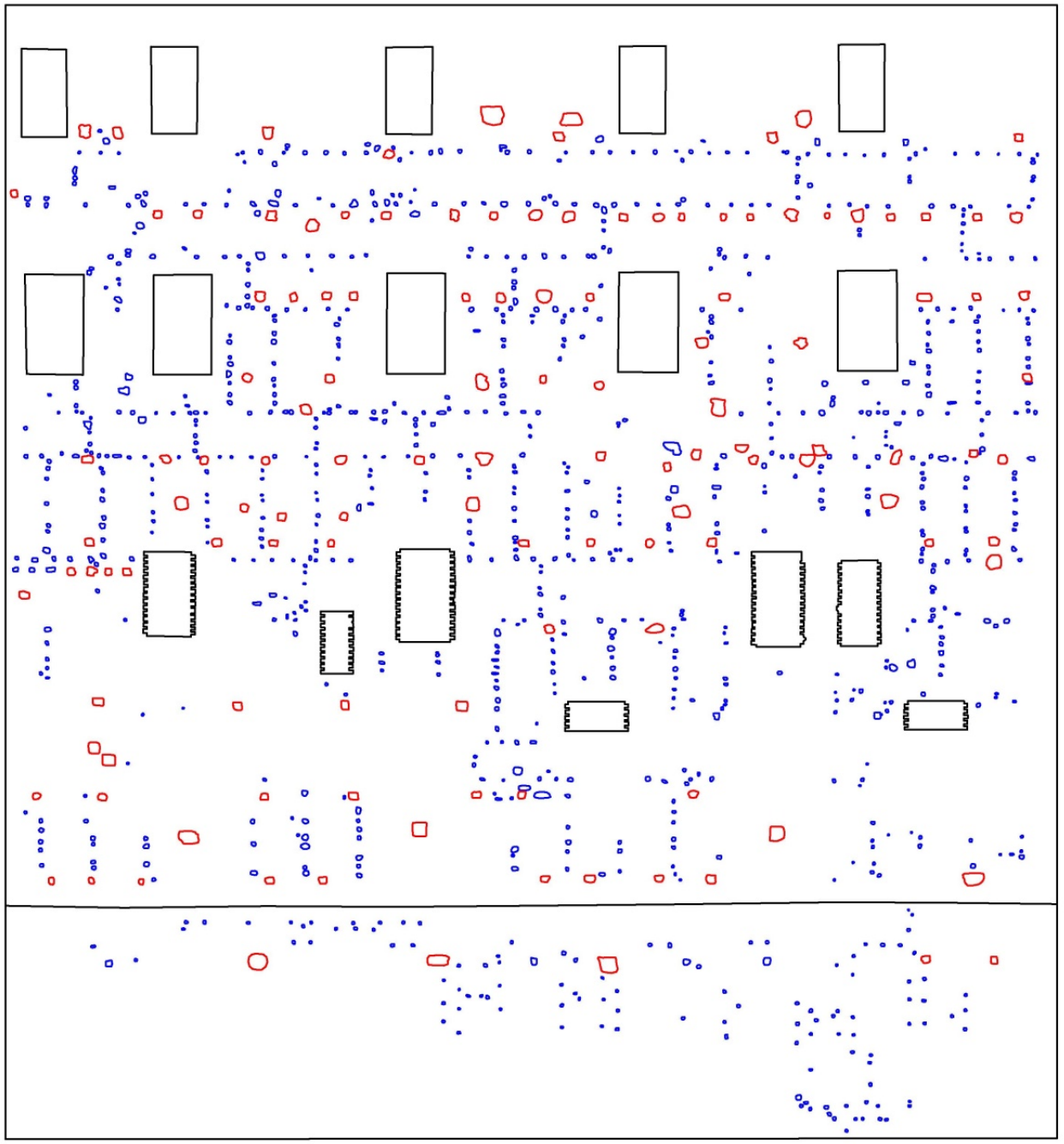

BA
Ss COSMA


INFORMAZIONI TURISTICHE
TOURIST INFORMATION
PASS
LIBRERIA / BOOKSHOP

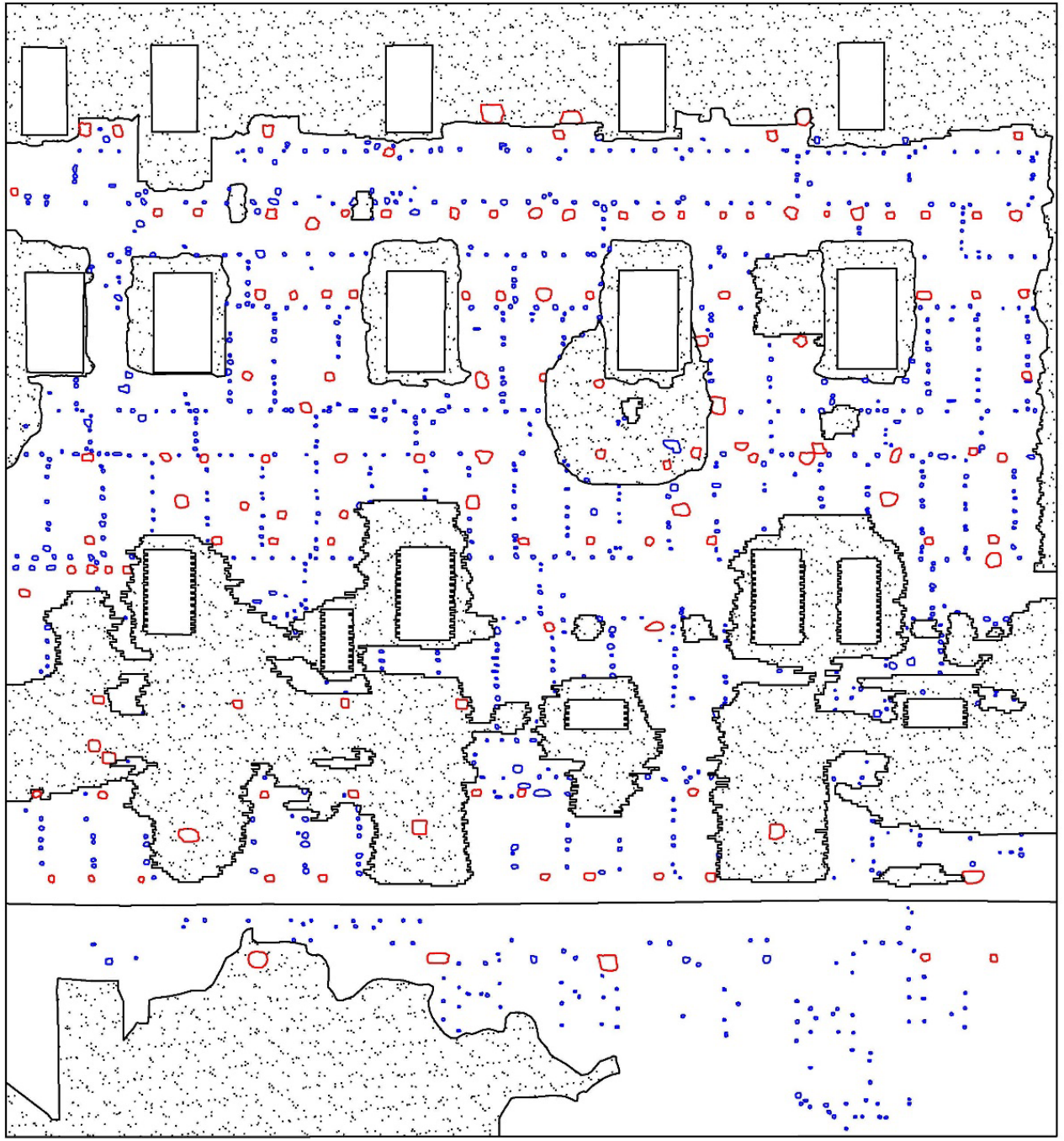

VIA
MIRANDA

Final Gigapan (Station 4)

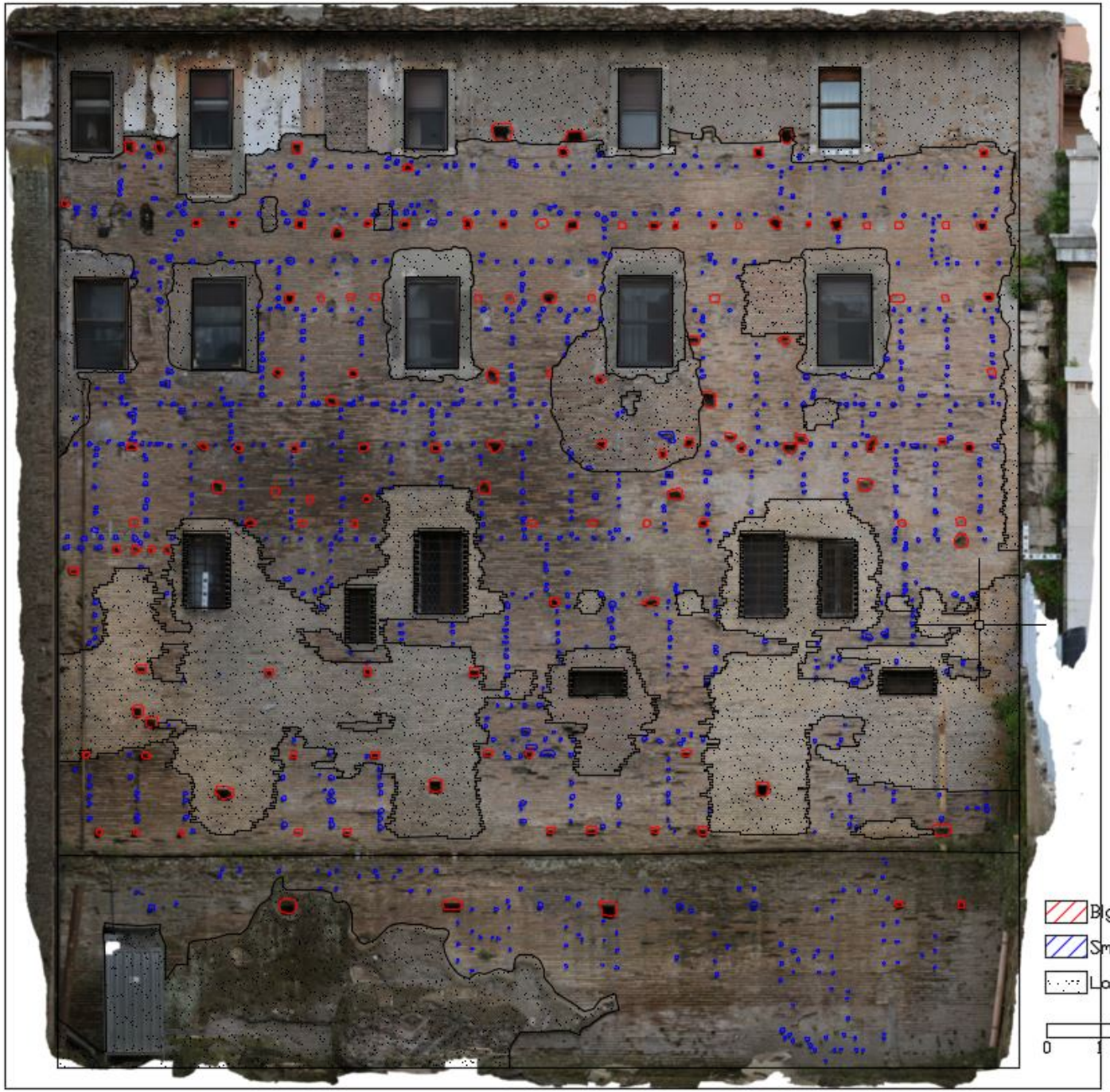
Final still orthophoto



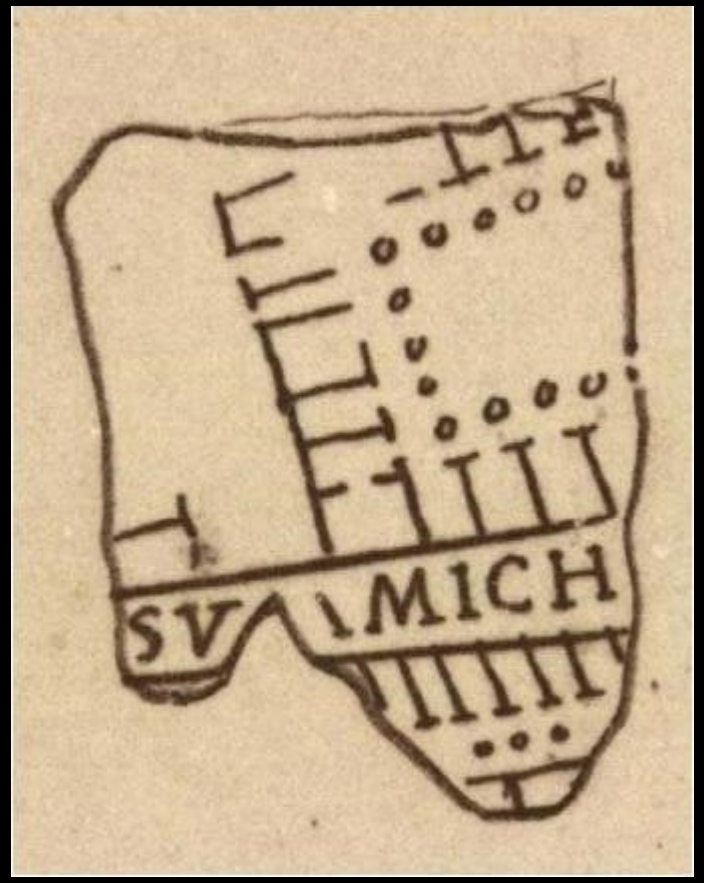
AutoCad scale line drawing of wall holes



AutoCad scale line drawing of wall holes with later construction


Big Holes
Small Holes
Later Contruction
0
1
2
3
4
5m

Fragment 3ab



Renaissance drawing from Cod. Vat. Lat. 3439 – Fo 20r
(Carettoni Pl. 10; Stanford)

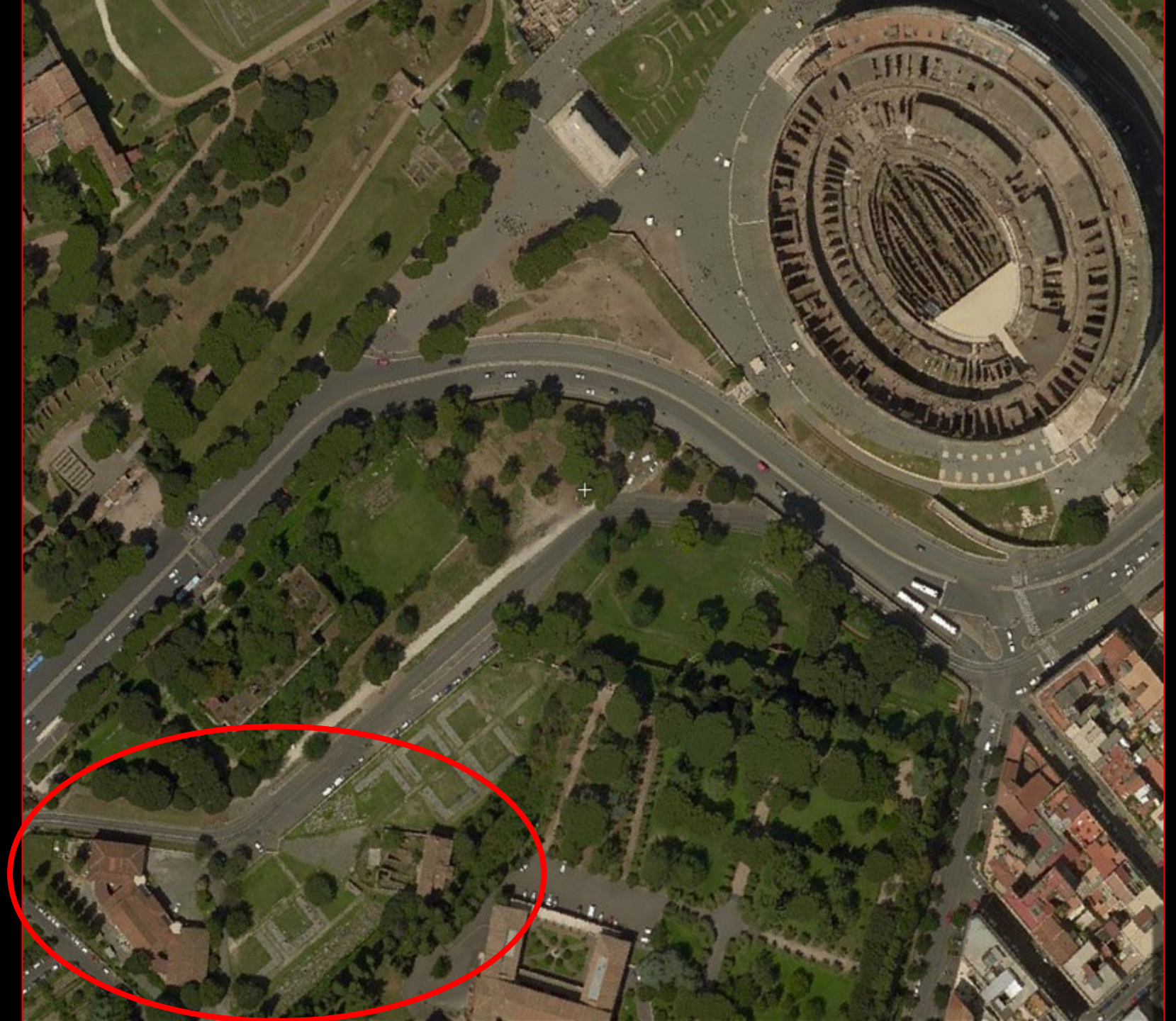
AG 3ab (Stanford)

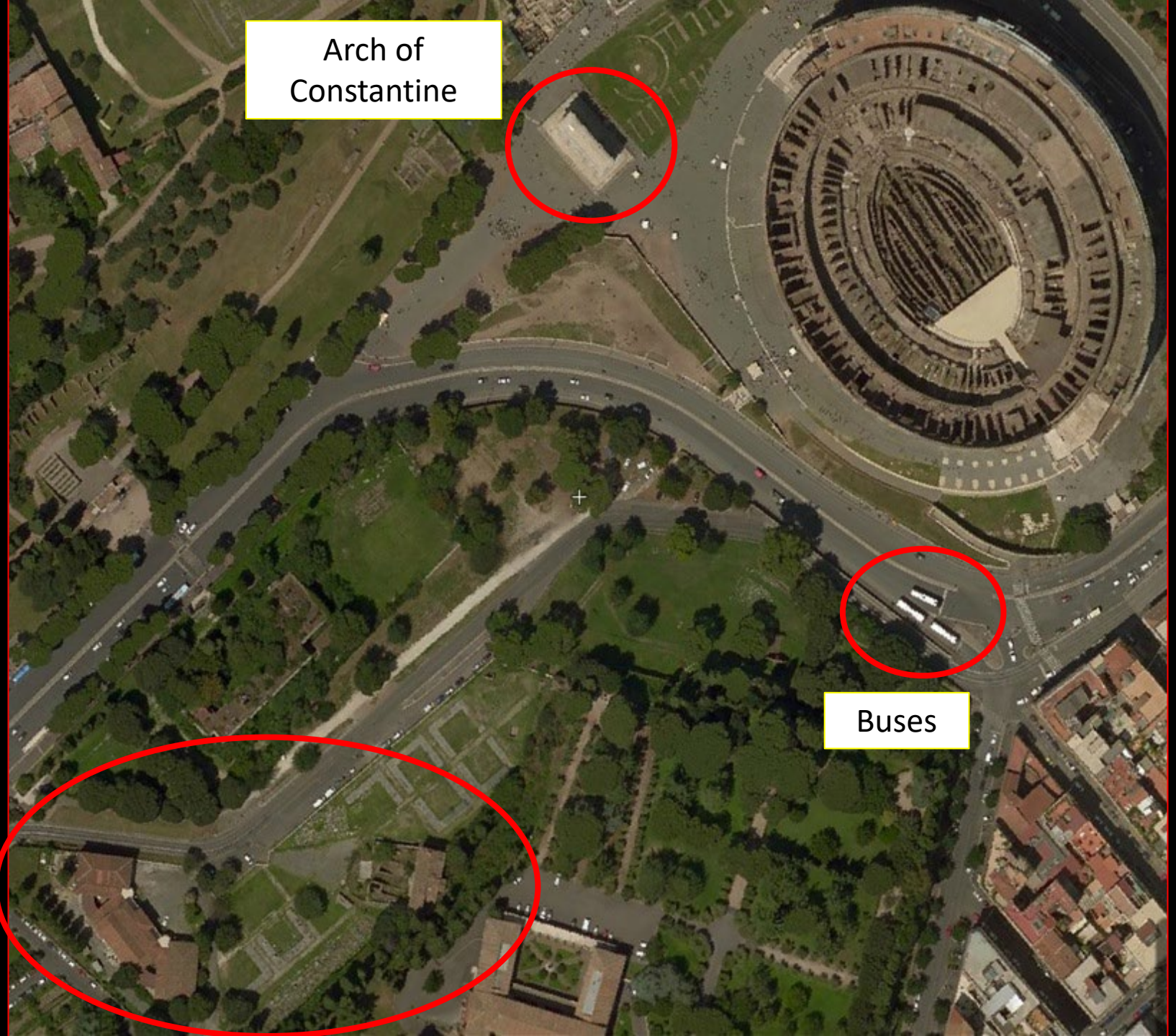
Sketchfab models of Fr 3ab

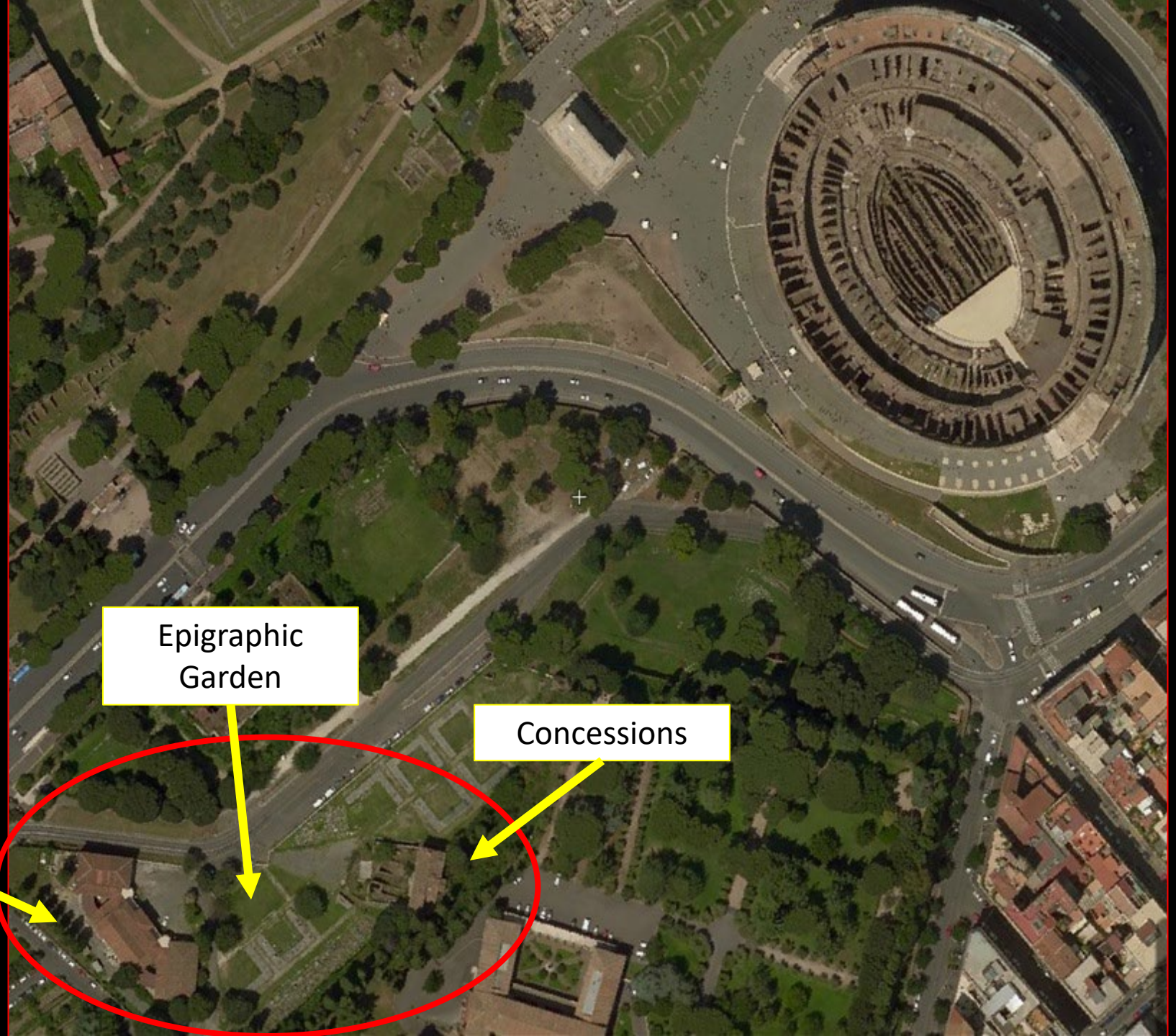
- Painted Model
- Painted Model with Blank Cast
- Painted Model with Numbers
- Painted Model with Specialist Annotations
- Painted Model with Non-specialist Annotations
- Painted Model with School Annotations

PARCO ARCHEOLOGICO DEL CELIO

Artist’s rendition of Great Marble Map display room in Caelian Hill Archaeological Park (© Sovrintendenza Capitolina)




Arch of Constantine
Buses


Epigraphic Garden
Concessions
GMM Museum

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Special thanks to:

Sovrintendente Claudio Parisi Presicce
Dott. Claudia Cecamore
Dott. Laura Petacco
Father Daniel and the Franciscan Brothers of the Third Order Regular
Dott. Daniele Maras
The Italian Army
Jenny Johnson
Derek Miller
IUPUI Library Center for Digital Scholarship